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HANDBOOK FOR KLYSTRON POWER SUPPLY TYPE 604

MP MASTER

FLANN MICROWAVE INSTRUMENTS LTD.

KLYSTRON POWER SUPPLY TYPE 604

The Type 604 is intended for use with the modern type of low voltage, medium power, klystron. It has a very convenient range of cathode to resonator voltages and also a comparatively high reflector voltage.

Specification

		Stabilisation for ±10% mains change	Ripple	Impedance Max.
Resonator	-250 to -400V at 50 mA	0.05%	1mV	1 ohm.
Reflector	10-500V at 500 microamps	0.05%	.5mV	25K ohm.
Heater (unstabilised)				
Modulation	Square wave 1:1 1-4 Kc/s 0-200V amplitude variable Saw-tooth 2 Kc/s amplitude variable.			

Circuit Description

Cathode Supply

The cathode, or resonator, voltage is derived from a full wave rectifying circuit which is first of all smoothed fairly efficiently in a conventional reservoir capacitor and choke smoothing circuit. The unstabilised but smoothed H.T. is used to drive, after further R.C. smoothing, the modulating circuits V.5 forming the square wave modulating circuit, and V.6 forming the function of either the squareing valve, when used in the square wave modulator, or a saw tooth generator of the Miller Transitron type.

The resonator potential is assumed to be earthy since this is the most convenient way of running a modern klystron, therefore the cathode voltage is negative with respect to earth. The cathode voltage may be varied from -250 to -400 and deliver a maximum of 50 milli amp under those conditions.

The circuit consists of a modern type of series parallel stabiliser where V.2., a power triode, forms the series valve and the feedback path goes via two double triodes V.3 and V.4. In valve V.4 only one half is used as an amplifier whilst the other half is strapped to the diode and is used to offset the heater drift in the first half of V.4 which results, normally, in over-compensation.

The actual reflector supply is used as the reference voltage and appears via the cathode voltage setting potentiometer at the grid of the amplifying half of V.4. The signal is highly amplified and fed to the grid of one half of the double triode V.3. This half acts as a cathode follower driving the second half of this valve at its cathode whilst the grid is at a fixed potential determinated by two high stability resistors. Therefore an amplified, but not phase inverted, signal appears at the second half of V.3. This is applied directly to the grid of the series valve. As a result of the high amplication of the circuit one obtains a highly stable and very well smoothed output voltage.

Reflector Supply

The reflector is somewhat similar in operation in as much as the full wave rectifying system with conventional L.C. smoothing is used and also the series parallel stabilisation pattern follows. Because very little current is taken out of this supply it has not been necessary to use two double triodes in the feedback path. Instead one double triode is used in cascode fashion to amplify the voltage derived from a potential divider across the supply. The bottom half of the double

triode has its cathode potential fixed through the action of a neon reference tube V.9 whose anode is directly connected to the top half of the cathode circuit. Therefore at the anode end of the top half, the signal which is inverted only once in respect to the signal at the grid of the bottom half, appears, and this is connected directly to the grids of a double triode strapped in parallel, acting as the series valve.

It may be noticed that there is a 220K resistor connected between the positive side of the supply and the common junction of the top half, and anode of the bottom half of the double triode. At first it would appear that this resistor merely shunts the signal and should result in a lower amplification of the feedback circuit. In fact this is not true, the resistor supplies current to the bottom half which is necessary for this half to operate efficiently in order to drive the cathode of the upper half.

Heater drift compensation is derived from the Edison effect of the double diode V.10. An almost exact compensation of heater variation is possible by the correct setting of the 'set compensation' potentiometer. Due to ageing of valves it may be necessary after a year of operation to reset this potentiometer. A special differential voltmeter is necessary to obtain correct settings and customers without such a device in their possession are advised to return the Power Supply to the makers for resetting.

D.C. Heater Supply

A variable D.C. heater supply is also available which is obtained from a fully screened 24V. winding on the transformer, and rectified via a bridge rectifier. The supply is of the choke input type and therefore has very good regulation, and since the choke is tuned the ripple is comparatively small.

Since the heater supply is unstabilised it is imperative that a heater load is always connected to the supply. Failure to observe this precaution may result in damage to the 1,000 uF electrolytic condenser in the smoothing circuit.

Modulation

The modulation facilities of the power supply includes square wave at a frequency variable between 1 Kc and 4 Kc and saw tooth at a fixed frequency of approximately 2 Kc. Square wave is derived from a conventional multi-vibrator circuit and the frequency variation is effected by means of a double twin ganged potentiometer. In the case of square wave modulation the output from the multivibrator is fed into a pentode V.6, which squares the wave form even further and provides a comparatively low output impedance.

The height of the square wave may be varied between approximately 200 V. peak to peak to some 10 V. peak to peak. The square wave is clamped to the reflector and is D.C. restored in both directions, i.e. the square wave excursion will not go more positive than the cathode potential of the klystron and will not go more negative than the D.C. level of the reflector voltage selected by means of the reflector potentiometer. It is, therefore, in general not necessary to alter the modulation amplitude of the square wave supply in any way since the D.C. restoring circuit does this automatically.

A small amount of overshoot at the beginning and end of the pulse is possible if too many volts of square wave are applied to the D.C. restoring circuit when the reflector voltage is comparatively low. This may best be judged by the results

obtained after passing the output from the klystron through a selective amplifier. It can be seen that the setting of the modulation amplitude under these circumstances is not very critical but some optimum point may be found for the operation required.

When a reflector voltage higher than 200 V. is applied to the klystron the modulation amplitude should ideally be set to the maximum level permanently. The height of the square wave is not important unless one is unlucky enough to have an amplitude which happens to coincide exactly with the peaks of two reflector voltage modes in such a case of course the amplitude should be readjusted.

External modulation may be applied to the circuit or internal modulation may be taken out of the circuit for synchronization purposes. The same coaxial socket covers both applications.

The sort of modulation which would normally be used for frequency modulating the klystron is derived from a comparatively conventional Miller transitron time base. In this case the time base output is applied directly to the reflector without any D.C. restoration since this is the most convenient way of frequency sweeping the klystron. Modulation amplitude in this case is vital since the amount of voltage applied to reflector will be directly proportioned to the frequency excursion.

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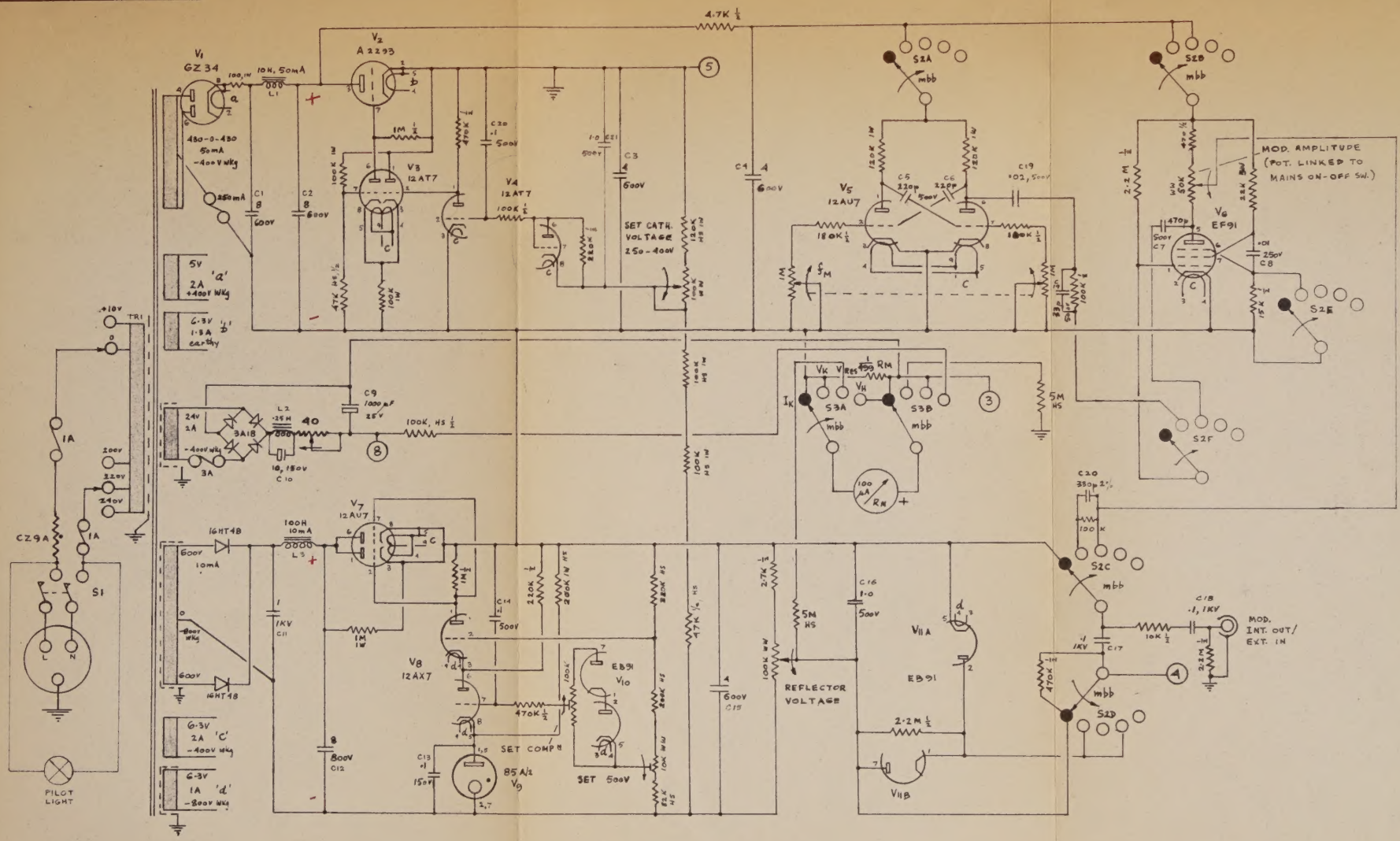

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